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Article

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Determinants of foreign direct investment: a comparative analysis of Turkey and Poland

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Abstract: There exists vast literature on the determinants and effects of Foreign Direct Investment (FDI). The issue has increased in importance due to strong globalization processes. Many developed and developing countries try to attract FDI to support their economic growth and development. However, empirical results show an ambiguous relation between FDI and economic growth. In this article, the determinants of FDI in Poland and Turkey are compared based on monthly data from 2000-2009 with help of the Granger causality test and the Vector Auto-regression Model. It is concluded that FDI inflows are positively correlated with market size and openness of the economy in Poland. For Turkey, a bidirectional relationship between FDI and market size as well as between FDI and openness of the economy has been observed. No relation between FDI and inflation has been found.

Keywords: *Foreign Direct Investment, economic growth, market size, openness, Granger Causality, Vector Auto-regression*

1. Introduction

As many developing countries do not possess the resources for investment due to low levels of saving related to (relatively) low levels of national income, macroeconomic policy often focuses on the attraction of Foreign Direct Investment (FDI). FDI should not only lead to investment enhancing productivity by way of transfer of technology and stimulating innovation. It should also lead to an increase in employment and economic development in general (see Todaro, 1997).

On a global scale, FDI has been increasing significantly during the last decades (Table 1). Global FDI inflow amounted 1401.4 billion USD in 2000, and increased to almost 2100 billion USD in 2007. An increasing trend can be observed in all parts of the world. However, the increase was the strongest in the developing economies. The financial crisis of 2008 which started in the United States of America (Akerlof and Shiller, 2009) caused a significant decrease in FDI flows in the developed world in that year. In all other part of the world FDI was still increasing. Only in 2009 a decrease could be observed, which was probably mainly the effect of withdrawal of funds from the developing economies by the developed countries which were hit by the financial crisis. The FDI outflow from the developing economies declined from over 1570 billion USD in 2008 to a little over 820 billion USD in 2009, a decline of more than 47%. The relative decline in FDI outflow from the developing countries was smaller, from 296.2 billion USD in 2008 to 229.1 billion USD in 2009, a decline of about 23%.

Table 1. FDI flows, by region, 1990–2009 (Billions of dollars)

Region	FDI Inflows					FDI Outflows				
	1990	2000	2007	2008	2009	1990	2000	2007	2008	2009
World	207.6	1401.4	2099.9	1770.8	1114.1	241.4	1232.8	2267.5	1928.7	1100.9
Developed Economies	172.5	1137.9	1444.0	1018.2	565.8	229.5	1094.7	1923.8	1571.8	820.6
Europe	104.4	724.8	988.4	551.0	378.3	139.3	867.6	1367.6	992.1	439.5
Developing Economies	35.0	256.4	564.9	630.0	478.3	11.9	134.9	292.1	296.2	229.1
Africa	2.8	9.8	63.0	72.1	58.5	0.6	1.5	10.6	9.9	4.9
Latin America and Caribbean	8.9	97.6	163.6	183.1	116.5	0.3	49.7	55.9	82.0	47.4
Asia and Oceania	23.3	148.9	338.2	374.6	303.2	10.9	83.7	225.5	204.3	176.7
South and Eastern Europe and Commonwealth of Independent States	-	7.0	90.9	122.5	69.9	-	3.2	51.5	60.6	51.1

Source: WIR 2010: 167-171, UNCTADSTAD, UnctadStat-Table view-Inward and outward foreign direct investment flows, Annual, 1970-2009, <http://unctadstat.unctad.org/TableViewer/tableView.aspx>

Since the 1950s, a number of theories and perspectives have been developed in order to explain the relation between FDI and economic growth research the determinants of FDI. Both theoretical and empirical research on the determinants for FDI emphasize differing causal

relationships. According to the so-called optimistic view, FDI inflows may boost the productivity of all firms by way of transfer of technology and business know-how, in particular to the poorest countries (Romer, 1993). Endogenous growth theories (Barro, 1991; Barro and Sala-I-Martin, 1995; De Mello, 1999; Eller et. al, 2005) made it possible to include FDI as one of the determinants of long-run economic growth (Al-Iriani and Al-Shamsi, 2007: 4). Several studies examined the main determinants of transmission between FDI and economic growth. Neoclassical and endogenous growth theories emphasize strongly the role of FDI in promoting economic growth in host countries. According to neoclassical growth theory (Romer, 1986; Lucas, 1988; Grosman and Helpman 1991; Baro and Salai-I-Martin, 1995), FDI promotes economic growth in a capital scarce economy by increasing the volume as well as efficiency of physical investment (Adhikary, 2011: 16).

However, it is argued by the neoclassical growth model that technological progress and labour growth are exogenously determined. The main result of FDI inflows is an increase in investment, leading only to an increase in per capital national income in the short-term. However, later in the 1980s it was recognized that FDI could lead to technology transfer and different kinds of positive spillover effects (Kok and Ersoy, 2009; Jayachandran and Seilan, 2010: 74).

There are many empirical studies on the impact of FDI. Borenztein (1998) used a panel data approach in order to compare the influence of FDI on economic growth among 69 developing countries. He concluded that FDI supports economic growth in all the countries researched. Bashir (1999) researched the effect of FDI in developing countries by using a panel fixed effect model and a random effect model. He also concluded that FDI inflows positively influence economic growth. Zhang (2006), using provincial data analyzed with a panel fixed effect model, finds a positive relation between FDI and economic growth in China. Wei et al. (2001) as well as Bende-Nabende and Ford (1998) show that FDI can be beneficial for economic growth as a result of technology transfer and positive externalities (e.g., multiplier effects) (Kotrajaras, 2010:8). Bende et al. (2001) analyzed the impact of positive externalities (or, spillover effects) of FDI on economic growth of the ASEAN-5¹ countries. Comparing data for the period 1970-1996, they show that GDP growth increases as a result of positive externalities, as well as other effects. Bengoa et al. (2003), American countries over the period 1970-1999, show that FDI significantly supports economic growth (Khaliq and Noy, 2007: 8).

¹ ASEAN-5: Singapore, Indonesia, Malaysia, Philippines, Vietnam, Thailand

However, well developed human capital seems to be a pre-condition for FDI to support economic growth (Wang and Wong, 2004). This thesis is supported by results from research on Asian countries (1987-1997) (Lan, 2006: 10). Apergis et al.(2007) conducted a study on 15 member-countries of the Organisation for Economic Co-operation and Development (OECD) and 50 non-OECD countries. They found a positive relationship between financial deepening and economic growth. In a study carried out in 27 so-called transition countries (with the economic system changing from a socialist economy into a market type economy) for the period 1991-2004 using panel co-integration and causality test, it is shown that high levels of income and successful privatization programs are a condition for FDI to be successful (Kornecki and Raghavan, 2011: 24).

However, although many studies show a positive relation between FDI and economic growth, such a relation is not found in other studies. A reason may be that the determinants for FDI to be successful may differ. Choe (2003), analyzing 80 countries over the period 1971-1995, found an insignificant positive relation. In a study on 20 OECD countries for the period 1981-2000, Kang and Du (2005) concluded there is no significant relation between FDI and GDP growth. In a study of 72 countries for the period 1960-1995, Carkovic and Levine (2002) came to the same conclusion. In a study on 8 transition countries for the period 1994-2001, Mencinger (2003) found a *robust negative causal relationship* between FDI and growth. Similar results were obtained by Salz (1992) for 68 developing countries (1970-1980) (Ozturk, 2007: 87).

Human capital and the level of income may be important determinants of FDI. Another determinant of FDI is the level and volatility of inflation. Akinkugbe (2003) found that the inflation rate does not play a significant role in attracting FDI in developing countries. While Udoh and Egwaikhide (2008) indicated that inflation volatility adversely affects FDI for Nigeria, Glaister and Atanasova (1998), Coskun (2001) as well as Wint and Williams (2002) found that lower inflation supports FDI. Other important factors may be the size of the market, related to the level of income, the openness of the economy (i.e., the level of trade barriers existing) and the level of inflation. These factors influence the expected return, transaction costs and risk of FDI. Different studies confirm the positive relation between market size and FDI (Schmitz and Bieri, 1972; Root and Ahmed, 1979; Kravis and Lipsey, 1982; Culem, 1988; Bajo-Rubio and Sosvilla-Rivero, 1994; Barrel and Pain, 1996; Chakrakarti, 2001; Fedderke and Romm, 2006; Brouwer et al., 2008; Fuentes, 2009). There is also much evidence on the importance of openness of the

economy and export-promoting trade and investment strategies as a determinant of FDI (Root and Ahmed, 1979; Balasubramanyam and Salisu, 1991; Jackson and Markowski, 1995; Chakrabarti, 2001; Lan, 2006).

The authors of this study will look at the markets size, openness of the economy and inflation rates as determinants of FDI Data for Turkey, candidate for membership of the EU, and Poland, EU member since 2004, will be compared, and besides the mentioned determinants of FDI, the link between FDI and economic growth will be analyzed.

2. The FDI profile of Poland and Turkey

Poland was formally a so-called socialist planned economy until the end of the 1980s. FDI was hardly of any importance, except maybe for some joint ventures. There also were serious limitations on technology transfer. The creation of a market economy and liberalization of international trade should increase the opportunity for FDI inflow and technological development. Much of the technology used was outdated, while the large former state-owned enterprises needed to be restructured and / or privatized. As in Poland itself there were no large private entities with enough financial means, FDI would be a mean to solve this problem (see Lavigne, 1999; Platje, 2004). The lifting of barriers for foreign capital and creation of trade relations with developed market economies would not only support increase in productivity, but also facilitate the transformation to a market economy (Barrel and Holland, 1999: 8).

FDI was of key importance in the transformation of Poland. The acceleration of FDI in the mid-1990s was supported by liberalization of capital movements as a result of Poland's process to prepare for joining the EU. Another incentive was large scale privatization schemes with involvement of foreign strategic investors (Lorentowicz, 2005: 18). Other important determinants of FDI may have been Poland's membership of the OECD (1996), NATO (1999, increasing its political stability) and EU (2004). The FDI inflow increased at a relatively stable pace (Wójcik, 2004).

In general, FDI flows seem to increase during times of rapid economic growth. While the level of FDI in Poland reached 19.6 billion USD in 2008, due to the influence of the financial crisis it declined to 15.1 billion USD by the end of 2011 (UNCTAD, 2011). The size of the

market is supposed to be one of the most important determinants of FDI. Poland was the 7th largest economy in the European Union and the 20th largest in the world in 2010, measured in current prices (Sawa, 2012). With its almost 40 million customers, Poland's market is larger than those of the Czech Republic, Slovakia and Hungary combined (Żywica et al., 2004: 81). While the country has recorded impressive growth rates in recent years, since 2012 it is one of the best economic performers within the OECD when considering real GDP growth (OECD, 2012).

Also in Turkey, liberalization was an important determinant of FDI. Reforms carried out in the 1980s aimed at retreat of the government from the economy, supporting the development of a market economy while becoming more open to the world economy (Erdal and Tatoğlu, 2002). As a part of the liberalization program, provisions for buying land were changed and tax exemptions introduced. The reform was a step away of the import substitution strategy (Balasubramanyam, 1996) and the market economy relatively closed to foreign companies (Sat, 2011: 945), which before the 1980s was a reason for low levels of FDI Turkey compared to other countries. The cumulative FDI until 1980 was only \$228 million (Erdal and Tatoğlu, 2002). The change from import substitution to an export led growth strategy was a factor in the inflow of amounted to an inflow of about 14.7 billion FDI during the period 1980-2002. The largest part flew into the country between 1990 and 2002 (Alici and Ucal, 2003). Internal crises in 1994 and 2000/2001² caused FDI to decline. The introduction of the FDI Act in 2003 had as an aim the elimination of bureaucratic procedures, strengthening the rights of foreign investors, and abolishment of minimum capital requirements. Afterwards, an increase in the volume of FDI could be observed. Total net FDI³ increased by 54% during 2002-2003, 59% during 2003-2004, 26% during 2004-2005, 99% during 2005-2006 and 10% during 2006-2007 (Sat, 2011: 945). Like in most developed and developing economies, FDI declined in 2009 as a consequence of the global financial crisis from 22 billion USD in 2007 to 7.6 billion in 2009.

In Table 2, the figures of FDI flows and stocks are compared for Turkey and Poland. As of 1995–2005, the amount of foreign capital inflows amounted 2.1 billion USD in Turkey and 6.7

² In Turkey, three major economic crises occurred in April 1994, November 2000 and February 2001. The reason for the first one was mainly the growing domestic debt stock. The reason of the other crises is the poor macroeconomic performances and financial turmoil. With the effects of these crises, huge amount of capital flew out of the country (See Celasun, 1998; Özatay and Sak, 2003).

³ FDI net inflows are the value of inward direct investment made by non-resident investors in the economy in question, including reinvested earnings and intra-company loans, net of repatriation of capital and repayment of loans (See UNCTAD, 2009).

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billion USD in Poland. The difference decreased in the period 2007-2009. While in Turkey FDI inflows totaled 22 billion USD in 2007, it decreased to 18.1 billion USD in 2008 and 7.6 billion USD in 2009 as a consequence of the global financial crisis. For Poland, FDI inflows amounted to 23.5 billion USD in 2007, and decreased to 14.6 billion USD in 2008 and 11.3 billion USD in 2009.

Table 2. FDI Flows and Stocks in Poland and Turkey during 1995–2009 (Billions of dollars and percentage)

FDI Flows ⁴						As a Percentage of Gross Fixed Capital Formation			
		1995–2005	2007	2008	2009	1995–2005	2007	2008	2009
Poland	Inward	6.7	23.5	14.6	11.3	17.1	25.7	12.8	12.6
	Outward	0.4	5.4	2.9	2.8	1.2	5.9	2.5	3.2
Turkey	Inward	2.1	22.0	18.1	7.6	4.0	15.9	12.5	7.3
	Outward	0.4	2.1	2.5	1.5	0.9	1.5	1.7	1.5
FDI Stocks ⁵						As a Percentage of Gross Domestic Product			
		1995	2007	2008	2009	1995	2007	2008	2009
Poland	Inward	7.8	178.4	163.3	182.7	5.6	42.0	31.1	42.5
	Outward	0.5	21.2	22.5	26.2	0.4	5.0	4.3	6.1
Turkey	Inward	14.9	153.1	70.1	77.7	6.7	23.7	9.6	12.6
	Outward	1.4	12.1	13.7	14.7	0.6	1.9	1.9	2.4

Source: WIR, 2010: 167-171, UNCTADSTAD, UnctadStad-Table view-Inward and outward foreign direct investment flows, annual, 1970-2009, <http://unctadstat.unctad.org/TableViewer/tableView.aspx>, Country Fact Sheet; Poland, Turkey.

Although it has a different economic background, Poland, as well as other Central and Eastern European countries, competes strongly with Turkey in order to attract FDI. As a share of Gross Domestic Product (GDP), for the period 1998-2003 Turkey with less than 1% remained behind Bulgaria (6%), Romania (3%) and the groups of countries Poland, Hungary and the Czech Republic (average 4.3%) (Karaege, 2006).

⁴ “Flows of FDI comprise capital provided (either directly or through other related enterprises) by a foreign direct investor to an enterprise, or capital received from an investing enterprise by a foreign direct investor. FDI has three components: equity capital, reinvested earnings and intra company loans (UNCTAD, 2007: 245)”.

⁵ “FDI stock is the value of the share of their capital and reserves (including retained profits) attributable to the parent enterprise, plus the net indebtedness of affiliates to the parent enterprise (UNCTAD, 2007: 246).”

In Table 3, the Inward FDI Performance Index and Inward Potential Index prepared by UNCTAD is shown. This index provides an indication of the attractiveness of a country for FDI. For the FDI performance index, the countries are ranked according to the level of FDI relative to their GDP. The Inward FDI Potential Index is based on several quantifiable indicators such as the level of GDP per capita, the rate of GDP growth over the previous 10 years, exports as a share of GDP, the average number of telephone lines per 1,000 inhabitants, commercial energy use per capita, spending on research and development as a share of GDP, the share of post-secondary school students in the population, country risk, as well as the world market share in exports of natural resources and services, imports of parts and components for automobiles and electronic products, and the country's stock of inward FDI as a share of the world total. According to these indices, Poland has a competitive advantage over Turkey.

Table 3. Inward FDI Performance Index, Inward FDI Potential Index

Economy	Inward FDI Performance Index (ranking of countries)				Inward FDI Potential Index (ranking of countries)			
	2000	2007	2008	2009	2000	2007	2008	2009
India	117	111	82	63	92	84	84	-
Sweden	14	56	39	64	7	9	10	-
Poland	38	60	89	65	42	42	42	-
Denmark	4	85	125	66	21	23	24	-
Bolivia	20	96	85	67	75	95	90	-
Myanmar	74	124	120	107				-
Mali	71	131	102	108	114	123	123	
Turkey	126	91	95	109	70	73	76	-
Philippines	73	112	122	110	67	77	80	-
Azerbaijan	85	140	135	111	108	65	58	-

Source: UNCTAD, World Investment Report 2010, Annex Table 25. www.unctad.org/wir

Note: Covering 141 economies. The potential index is based on 12 economics and policy variables.

3. Research

The aim of the research presented below is to examine inflation, market size and openness of the economy as determinants of FDI in Turkey and Poland, applying the Vector Auto-regression (VAR) model (see Sims, 1980).

3.1. Definition of variables

The econometric model (for definitions see Table 4) used expresses FDI as a function of inflation rate (INF), market size (GDP) and openness calculated as $\text{Export} + \text{Import} / \text{GDP}$ (OPEN). The model is specified as: $\text{FDI} = f(\text{INF}, \text{GDP}, \text{OPEN})$.

Table 4. Definition of variables used for analysis

Dependent Variable	:	Ln (Nominal Foreign Direct Investments) (USD Dollar)
Independent Variable	:	
Inflation Rate (consumer price index)	:	$\ln(\text{CPI}) - \ln(\text{CPI})_{-1}$
Market size	:	$\ln(\text{Nominal GDP})$ (USD Dollar)
Openness rate	:	$(\text{Export (USD Dollar)} + \text{Import (USD Dollar)}) / \text{GDP}$

* **ln** denotes logarithmic values of data

The data on FDI, Inflation rate, Market size and Openness rate for the period from April 2000 to December 2009 were gathered from the Central Bank of the Republic of Turkey and Turkish Statistical Institute, while the data for Poland (January 2000 to February 2009) were obtained from data from the Polish National Bank.

In this study, we use logarithmic values of series except for the openness ratio, in order to protect series against heteroskedasticity with estimates of the Variance and autocorrelation errors. Moreover, quarterly time series are seasonally adjusted by using the Census X-12 ARIMA method. The reason for applying this method is that it is the standard used in official statistics in the united Kingdom, as agreed upon by the National Statistics Quality and Methods Programme Board in 2001, being in line with European best practice and consistent with guidelines from the Bank of England (TSAP, 2007).

3.2. Econometric analysis

The research of the relationship between openness, market size, inflation and foreign direct investment in Turkey and Poland for the period 2000-2009 begins with testing for

stationary, and then uses a Granger causality test and VAR model. The test of Granger-Causality (Granger,1969) is commonly applied in a wide range of studies testing the relationship between economic variables (see Ericsson and Irandoust, 2001; Chakraborty and Badu, 2002; Liu et al, 2002). According to Granger, the idea of Granger causality is based on the simple logic that a variable Y is caused by X, if Y can be predicted better from past values of Y and X than from past values of Y alone. Four patterns of causality can be distinguished: (a) unidirectional causality from X to Y; (b) unidirectional causality from Y to X; (3) feedback or bi-directional causality; and (d) no causality.

To test granger- causality and VAR method between the variables, we should begin by testing for non-stationarity in the three variables of FDI, INF, GDP, OPEN to avoid any spurious correlation (Gujarati, 1995:750). In order to check whether the time series are stationary, the Kwiatkowski-Phillips-Schmidt-Shin test was used (Kwiatkowski et al., 1992). A series is said to be stationary if the mean and auto covariances of the series do not depend on the time factor. In the KPSS test, stationarity is the null hypothesis and the existence of a unit root is the alternative. For the KPSS stationarity test, the t-statistic should be reported. If the critical t-statistic values are higher than the estimated ones, this would mean that the alternative hypothesis should be rejected (alternative Hypothesis: there is a unit root of the characteristic equation describing the time series).

Table 5. Kwiatkowski-Phillips-Schmidt-Shin Unit Root Tests (No Trends) (Poland)

Variable	Test Statistic	The critical value at 1% level of significance
(FDI)	0.093035 (3)	0.216000
(INF)	0.059433 (3)	0.216000
(GDP)	0.167814 (5)	0.216000
(OPEN)	0.112323 (2)	0.216000

* KPSS unit root test performed as a constant and trend model. The lag order was determined using the Newey-West Bandwidth Criterion (NBC)

* The number in the parenthesis indicates the lag order

The results of the Kwiatkowski-Phillips-Schmidt-Shin unit root test are displayed in Table 5 and 6 for Poland and Turkey. The results show that none of the variables has a unit root. Because alternative hypothesis of unit root is rejected, the variables to be used for analysis are stationary in levels (integrated of order 0). By using stationary data we can avoid the problem of spurious regression. When non-stationary time series are used in a regression model one may obtain apparently significant relationships from unrelated variables. This phenomenon is called spurious regression (Granger and Newbold, 1974). Therefore, as our data are stationary, this problem is avoided.

Table 6. Kwiatkowski-Phillips-Schmidt-Shin Unit Root Tests (No Trends) (Turkey)

Variable	Test Statistic	The critical value at 1% level of significance
(FDI)	0.103441 (4)	0.216000
(INF)	0.184991 (4)	0.216000
(GDP)	0.197094 (5)	0.216000
(OPEN)	0.068147 (4)	0.216000

* KPSS unit root test performed as a constant and trend model. the lag order was determined using the Newey-West Bandwidth Criterion (NBC)

* The number in the parenthesis indicates the lag order

Due to the stationarity of the data, the Vector Autocorrelation (VAR) method can be applied in order to determine relations among variables. This method developed by Sims (1980) is a strong technique which enables the estimation of dynamic interrelationships among economic variables. Moreover, it allows for capturing empirical irregularities in the data and thereby provides insight into the channels through which the different policy variables operate (Hakro and Ghumro, 2007:11). An important aspect of empirical research in the specification of the VAR models is the determination of the optimal lag length. Therefore, the second step of this analysis is to check the optimum lag length to describe the causality before applying Granger causality test.

We estimate the optimal lag length for a VAR by using the Akaike and Schwarz-Bayesian information criteria (Akaike, 1973; Schwarz, 1978). In Table 7 and 8, the results of the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criteria (SC) are reported.

Table 7. Selection of lag lengths for VAR models (Poland)

lag length	LR	FPE	AIC	SC	HQ
0	3.21e-12	-15.11466	-14.75187	-14.99259
1	90.90420	2.96e-13	-17.51178	-16.42341*	-17.14558
2	33.78653	1.91e-13	-18.01107	-16.19712	-17.40073
3	30.38548*	1.19e-13	-18.64061	-16.10108	-17.78613
4	19.99601	1.12e-13*	-19.00398	-15.73887	-17.90537
5	15.35409	1.29e-13	-19.43011*	-15.43942	-18.08736*

* Represents criteria optimum lag length according to the AIC and SC,

* LR: Likelihood ratio, FPE: Final Prediction Error, SC: Schwarz Information Criterion, AIC: the Akaike Information Criterion, HQ: Hannan-Quinn Information Criterion

Table 8. Selection of lag lengths for VAR models (Turkey)

lag length	LR	FPE	AIC	SC	HQ
0	7.48e-10	-9.663156	-9.300366	-9.541088
1	116.2023	2.71e-11	-12.99725	-11.90888*	-12.63104
2	21.49567	2.98e-11	-12.96214	-11.14820	-12.35181
3	22.35194	2.82e-11	-13.16886	-10.62934	-12.31439
4	31.10740*	1.27e-11	-14.27299	-11.00789	-13.17438
5	18.85368	1.07e-11*	-15.01727*	-11.02658	-13.67452*

* Represents criteria optimum lag length according to the AIC and SC,

* LR: Likelihood ratio, FPE: Final Prediction Error, SC: Schwarz Information Criterion, AIC: the Akaike Information Criterion, HQ: Hannan-Quinn Information Criterion

Given the AIC and SC criteria, the optimal lag length is selected to be 1. After the determination of optimum lag length for the variables FDI, openness, market size and inflation, the Granger causality test was applied to investigate causality. In our study, we used the following pairs of regression equations in order to perform causality relation among our variables.

$$FDIt = a_0 + a_1FDIt - 1 + \dots + a_nFDIt - n + b_1Xt - 1 + \dots + b_mXt - m + et \quad (I)$$

$$Xt = c_0 + c_1Xt - 1 + \dots + c_nXt - n + d_1FDIt - 1 + \dots + d_mFDIt - m + ut \quad (II)$$

Where:

- $FDIt$ = foreign direct investment in year t ,
- Xt = three series (inflation, openness, market size) undergoing test to determine their causal relationship,
- Coefficients a , b , c and d are constants to be estimated,

- ϵ_t and u_t are two independent error terms.

Two hypotheses to be tested can be obtained from the above-written equations (Hussain and Liew, 2004):

i) If $H_A(1): b_1 = b_2 = \dots = b_m = 0$ is not rejected, then we conclude that X does not cause FDI .

Otherwise, we conclude that X causes FDI .

ii) If $H_A(2): d_1 = d_2 = \dots = d_m = 0$ is not rejected, then we conclude that FDI does not cause X .

Otherwise, we conclude that FDI causes X .

Tables 9 and 10 provide the results of the long run relationship between FDI inflows and the determinant variables (inflation rate (INF), market size (GDP) and openness calculated as $\text{Export} + \text{Import} / \text{GDP}$ (OPEN)) for Turkey and Poland. The next econometric step for our purpose is to examine the Granger – Causal relationship among the variables; x is said to “Granger – Cause” y if and only if the forecast of y is improved by using the past values of x together with the past values of y , then by not doing so (Granger 1969).

Table 9. The results of Granger Causality Test in VAR (Poland)

H_A Hypothesis	Degrees of Freedom	Chi-square	p-value
FDI granger does not cause INF	1	1.812905	0.9699
INF granger does not cause FDI	1	1.657168	0.1980
FDI granger does not cause GDP	1	4.431012	0.0353*
GDP granger does not cause FDI	1	1.650625	0.1989
FDI granger does not cause OPEN	1	2.718052	0.0992**
OPEN granger does not cause FDI	1	3.258910	0.0710**

(*) we accept the H_A Hypothesis at 5% and 10% significance levels, (**) we accept the H_A Hypothesis at 10% significant level.

Source: Authors' own elaboration.

Table 10. The results of Granger Causality Test in VAR (Turkey)

H_1 Hypothesis	Degrees of Freedom	Chi-square	p-value
FDI granger does not cause INF	1	0.665854	0.4145
INF granger does not cause FDI	1	2.114523	0.1459
FDI granger does not cause GDP	1	1.065173	0.3020
GDP granger does not cause FDI	1	10.52322	0.0012*
FDI granger does not cause OPEN	1	6.213658	0.0127**
OPEN granger does not cause FDI	1	1.537535	0.2150

(*) we accept the H_A Hypothesis at 1%, 5% and 10% significant levels. (**) we accept the H_A Hypothesis at 5% and 10% significant level.

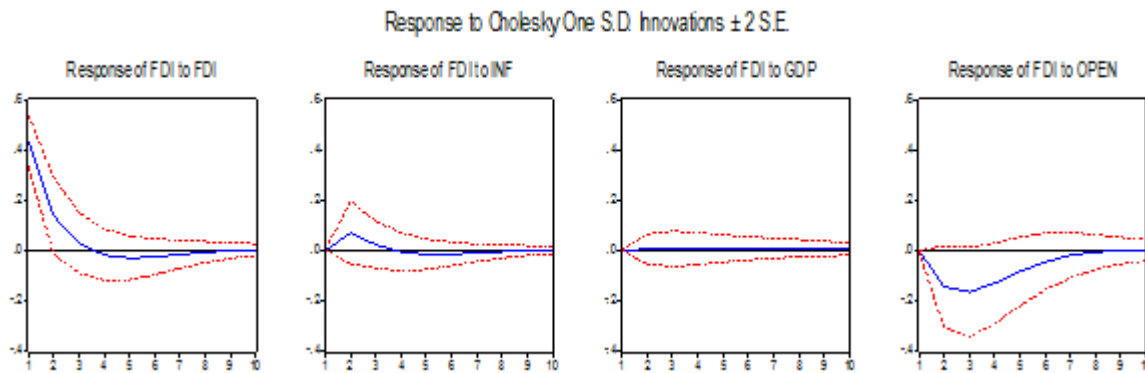
Source: Authors' own elaboration.

Based on the analytic results, three conclusions can be drawn for each country. For Poland, as is shown in Table 9, there is strong evidence of Granger causality running from foreign direct investment to market size. At the same time, we find evidence for uni-casuality between openness and foreign direct investment. Furthermore we find no causal relationship between foreign direct investment and inflation.

For Turkey, Table 10 shows that in this country, market size Granger-causes foreign direct investment inflows and in contrast to Poland we find bi-causality between openness and foreign direct investment inflows running from openness to inflow. Finally, similar to Poland, we find no causal relationship between foreign direct investment and inflation.

The next step in our VAR model is the dynamic impulse-responses and decomposition of the VAR systems. Impulse response functions are used to describe the effects of shocks on the adjustment path of the economic variables. The aim of an impulse response function is to identify the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables (Root and Lien, 2003). A shock to the i -th variable not only directly affects the i -th variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VAR. In Figures 1 and 2 we show the dynamic impulse-responses of the VAR systems for Poland and Turkey to identify the shocks.

Figure 1. Impulse Response Function of FDI: (Poland)

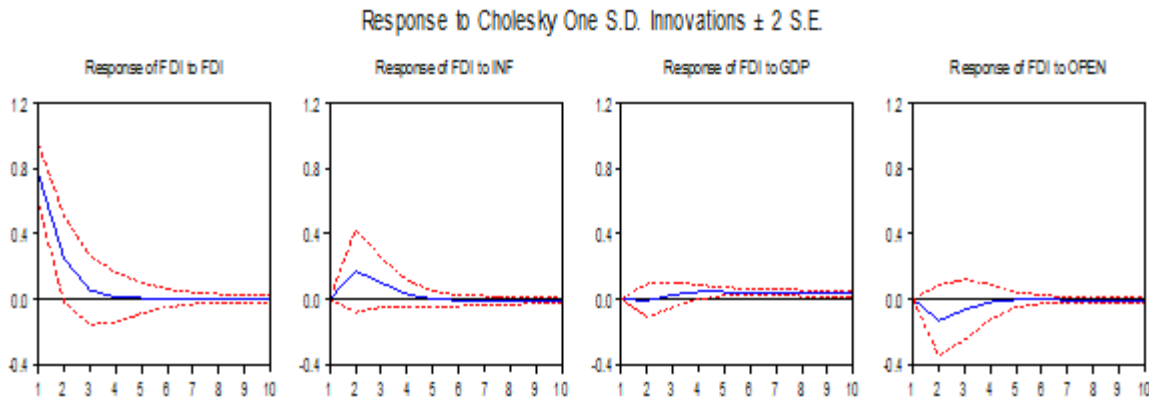


Source: Authors' own elaboration.

Figure 1 depicts the impulse responses of FDI to inflation, market size and openness for Poland. When analyzing the figure, it becomes clear that the response of FDI to inflation is positive for 2 years. However, for the rest of the years this shock negatively affects FDI and the effect of the shock is permanent. The response of FDI to market size is statistically

meaningless and the response of FDI to openness is negative for 3 years, while afterwards this shock is positively affects FDI.

Figure 2. Impulse Response Function of FDI: (Turkey)



Source: Authors' own elaboration.

Figure 2 depicts the impulse responses of FDI inflation, market size and openness for Turkey. It is shown that the response of FDI to inflation is positive for 2 years. However for the rest of the years this shock has no effect. The response of FDI to market size is positive for many years, while afterwards the effect slowly disappears. The response of FDI to openness is negative for 2 years and then this effect disappears quickly.

Figure 2 depicts the impulse responses of FDI inflation, market size and openness for Turkey. It is shown that the response of FDI to inflation is positive for 2 years. However for the rest of the years this shock has no effect. The response of FDI to market size is positive for many years, while afterwards the effect slowly disappears. The response of FDI to openness is negative for 2 years and then this effect disappears quickly.

In order to measure the effects of each variable (inflation, market size and openness) in VAR model, we use variance decomposition. It measures the percentage of variation in FDI investment induced by shocks emanating from its relevant determinants.

Table 11. Results of variance decomposition (Poland)

Periods	Standard Errors	FDI	INF	GDP	OPEN
1	0.437070	100.0000	0.000000	0.000000	0.000000
2	0.485923	88.91652	2.130269	0.011339	8.941872
3	0.514391	79.67731	2.113989	0.022388	18.18631
4	0.530973	74.88722	1.995163	0.038815	23.07880
5	0.538651	73.08320	2.021355	0.061372	24.83407
6	0.541370	72.57951	2.072288	0.086794	25.26140
7	0.542083	72.47470	2.096322	0.110853	25.31813
8	0.542222	72.45179	2.100753	0.130821	25.31664
9	0.542265	72.44050	2.100445	0.146005	25.31305
10	0.542307	72.43249	2.101214	0.156993	25.30930

Note: Ordering: FDI INF GDP OPEN

Source: Authors' own elaboration.

The estimates of variance decomposition are shown in Table 11 and 12. The results for Poland indicate that an average of 1.87 percent variability can be explained by inflation (INF), an average of 0.77 percent variability by market size, while 20.16 percent variability can be explained by openness. That shows that openness is the most important factor that affects FDI flows. However, we cannot ignore the impact of other determinants such as country risk, political stability, corruption, human sources.

Table 12. Results of variance decomposition (Turkey)

Periods	Standard Errors	FDI	INF	GDP	OPEN
1	0.766166	100.0000	0.000000	0.000000	0.000000
2	0.833105	93.23349	4.263086	0.012956	2.490471
3	0.843708	91.30072	5.553219	0.109514	3.036546
4	0.845557	90.91662	5.650030	0.362489	3.070865
5	0.846733	90.66911	5.634473	0.631153	3.065267
6	0.847793	90.44604	5.631741	0.862373	3.059843
7	0.848715	90.25116	5.633498	1.058163	3.057182
8	0.849522	90.08024	5.635998	1.227612	3.056146
9	0.850235	89.92930	5.638838	1.376306	3.055552
10	0.850866	89.79582	5.641850	1.507313	3.055012

Note: Ordering: FDI INF GDP OPEN

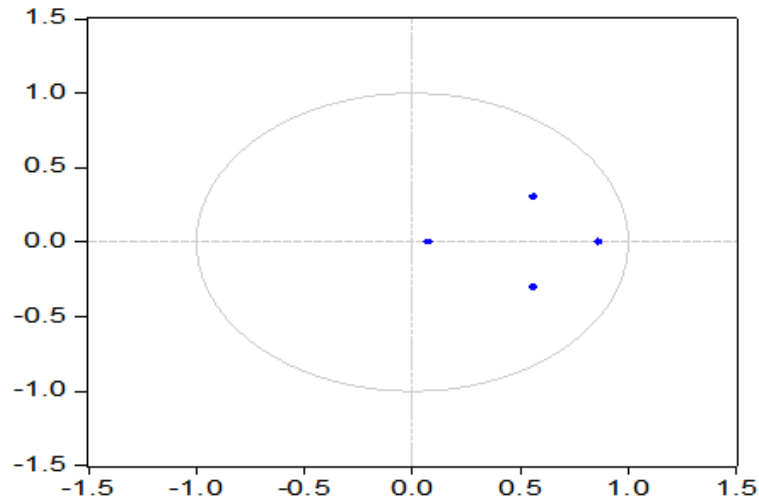
Source: Authors' own elaboration.

On the other hand, the results for Turkey indicate that an average of 4.93 percent variability accounted for by inflation, an average of 0.71 percent variability accounted for by market size, while 2.69 percent can be explained by openness. Thus, in this case inflation seems to be the most important factor that affects FDI flows. The necessary and sufficient

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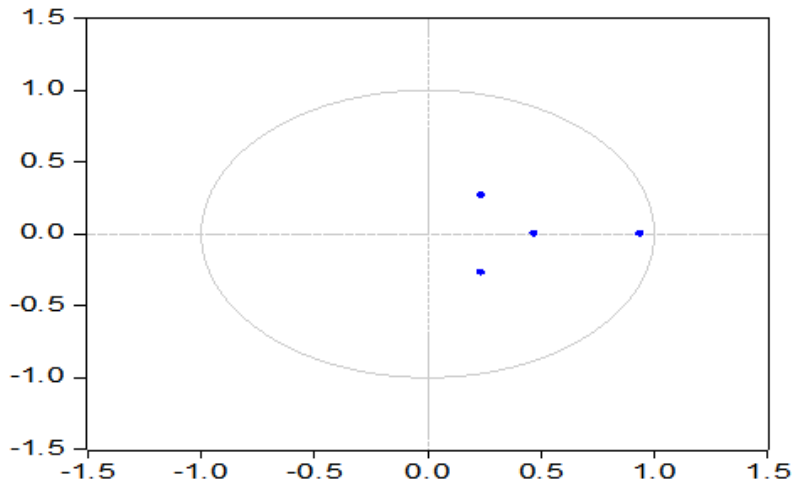
condition for stability and stationary for VAR model in this study is that all roots of the characteristic equation lie inside the unit circle (Banerjee et al., 1993). As shown by the inverse roots of the AR characteristic polynomial, the VAR result from the analysis satisfies the stability condition (Fig 3 and 4).

Figure 3. Stability Test Graph (Poland)



Source: Authors' own elaboration.

Figure 4. Stability Test Graph (Turkey)



Source: Authors' own elaboration.

4. Concluding remarks

FDI in Poland and Turkey has developed dynamically. In Poland, the transformation of the socialist planned economy to a market economy that started in 1990 created a strong impulse for FDI. Important factors are the size of the economy, economic growth and joining the European Union in 2004. Also in Turkey, FDI increased as a consequence of economic liberalization in the 1980s. In this paper, it was tried to analyze the importance of inflation, size of the economy and degree of openness of the economy for FDI for both countries.

We found evidence from our empirical data that FDI Granger caused market size in Poland and there is the evidence of uni-causality between openness and FDI. When we look into Turkey, market size (GDP growth) Granger caused foreign direct investment inflows and we found bi-causality between openness and foreign direct inflows running from openness to inflow. And finally similar to Poland, we found no causal relationship between foreign direct investment and inflation.

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Determinant bezpośrednich inwestycji zagranicznych: analiza porównawcza Turcji i Polski

Streszczenie

Literatura przedmiotu poruszająca zagadnienia związane z uwarunkowaniami oraz efektami Bezpośrednich Inwestycji Zagranicznych (BIZ, ang.: Foreign Direct Investment – FDI) jest bardzo rozległa. Kwestie te znacząco zyskały na znaczeniu z uwagi na silne procesy globalizacyjne. Wiele rozwijających się i rozwiniętych krajów usiłuje przyciągnąć BIZ w celu zdynamizowania wzrostu i rozwoju gospodarczego. Jednak badania empiryczne nie wskazują na wyraźny związek pomiędzy BIZ a wzrostem ekonomicznym. W niniejszym artykule dokonano porównania determinant napływu BIZ do Polski i Turcji w oparciu o miesięczne dane z lat 2000-2009 oraz przy wykorzystaniu testy przyczynowości Grangera i Modelu VAR. We wnioskach stwierdzono, że napływ BIZ w Polsce jest pozytywnie skorelowany z wielkością rynku oraz stopniem otwartości gospodarki. Natomiast w odniesieniu do Turcji zaobserwowano dwukierunkową zależność pomiędzy BIZ a wielkością rynku, jak też pomiędzy BIZ a otwartością gospodarki.

Słowa kluczowe: *Bezpośrednie Inwestycje Zagraniczne, wzrost gospodarczy, wielkość rynku, otwartość, test przyczynowości Grangera, model VAR*